

ADDITIONAL FEES:

No additional fees are believed required; however, should it be determined that a fee is due, authorization is hereby given to charge any such fee to our Deposit Account No. 01-0268.

REMARKS

In the last Office Action, the specification was objected to due to minor informalities. The Examiner stated that reference to Figs. 4 and 6 should be amended to refer to Figs. 4(a)-4(c) and 6(a)-6(b). Applicants note that the specification was revised by preliminary amendment to include the requested changes.

Claims 1-3, 19-22 and 32 were rejected under 35 U.S.C. §102(e) as being anticipated by Knight et al. ("Knight"). The Examiner stated that in Figs. 3, 21 and 22 Knight discloses a near-field optical head comprising a slider 310 supported by a suspension arm 2104 providing a load weight and obtaining a floating force due to a relative motion of the slider with respect to a recording medium 302 due to a balance between the load weight and the floating force, and a probe 340 provided in a bottom surface of the slider for producing a near-field light or converting a near-field light produced on a surface of the recording medium into a propagation light,

wherein the recording medium and the probe 340 interact through the near-field light when the slider undergoes scanning movement relative to the surface of the recording medium to effect at least one of the recording of information onto the recording medium and the reproducing of information stored on the recording medium, and wherein the probe protrudes from the bottom surface of the slider toward the recording medium so that a distance between the probe and the recording medium is smaller than a distance between the bottom surface of the slider and the recording medium.

The Examiner further stated that Knight discloses that the probe comprises a microscopic aperture or microscopic protrusion formed in the slider as recited in claims 2, 3, 21 and 22 (citing col. 69, lines 7-9; col 6, lines 37-40; and Figs. 3, 6, 21 and 22), and that the probe comprises a tapered projection mounted to the support member and having a sharpened tip protruding from the bottom surface of the support member as recited in claim 32 (citing col. 67, lines 4-8).

By the present response, the specification has been amended add a cross-reference to applicants' related application. Claims 2, 3, 9, 21 and 22 have been amended in minor respects to correct minor informalities and to clarify the scope of the invention. In other respects, all of pending

claims 1-32 remain unchanged and no substantive changes have been made to any of the claims which would necessitate a further search or the application of new grounds of rejection. Applicants therefore respectfully request that the next action not be made final in the event the present response does not lead to allowance and a new ground of rejection is applied against any of the pending claims.

Applicants respectfully submit that claims 1-3, 19-22 and 32 patentably distinguish over the prior art of record.

As pointed out at pages 2-3 of the specification, the structure of the conventional recording device having a flying head produces a film of air between a lower surface of a recording head serving as an air bearing and the surface of a recording medium. The distance between the air bearing surface of the recording head and the surface of the recording medium is as much as several dozen to several hundred nanometers. When attempting to employ a flying head configuration in a near-field recording device, however, high resolution and high efficiency recording and reading of data utilizing near-field light is not attainable. A distance of several dozen to several hundred nanometers between the air bearing surface of the recording head and the recording medium is too large to obtain the high-intensity near-field light

needed for high resolution. The intensity of near-field light decreases exponentially as distance increases. Since the recording head and the recording medium are spaced distant from each other relative to the wavelength of near-field light, only low intensity near-field light is produced. Thus, near-field light having an intensity sufficient to achieve high resolution recording or reading of data is not attainable.

When utilized in a near-field configuration, the flying head structure must be provided with a light emitting element or light detecting element positioned on the top surface of the recording head opposite the air bearing surface having a microscopic aperture provided therein. The distance between the aperture and the light emitting or detecting element is equal to the thickness of the slider of the flying head. Since this distance is typically large, the intensity of light illuminating the microscopic aperture by a light emitting element (or illuminating the light detecting element from the microscopic aperture) is small because the intensity of such light decreases proportionately with a square of the distance.

The present invention overcomes the foregoing drawbacks associated with use of the flying head structure in a near-field recording apparatus. In accordance with amended

independent claim 1, the inventive near-field optical head has a slider with a probe provided in a bottom surface thereof. A gap is formed between a recording medium and the bottom surface of the slider. Near-field light is produced or converted into propagation light by the probe and the recording medium and the probe interact through the near-field light when the slider undergoes scanning movement relative to the recording medium to effect recording or reading of information on the recording medium. As further recited by amended independent claim 1, the probe protrudes from the bottom surface of the slider so that a distance between the probe and the recording medium is smaller than a distance between a part of the bottom surface of the slider closest to the recording medium and the recording medium so that the probe can be brought to within several nanometers to several tens of nanometers close to the recording medium to enable high resolution optical reading and/or recording of data on the recording medium.

Amended independent claim 19 contains similar language, and recites a near-field optical head having a support member and a probe protruding from a bottom surface thereof such that a part of the bottom surface of the support member closest to a sample is more distant from the sample than the probe so that the probe can be brought to within

several nanometers to several tens of nanometers close to the sample.

Knight fails to identically disclose the claimed subject matter of amended independent claims 1 and 19. Anticipation under 35 U.S.C. §102 requires the disclosure, by a single reference, of all claimed subject matter. Absent disclosing that the distance between the probe and the recording medium (or sample) is smaller than a distance between a part of the bottom surface of the slider closest to the recording medium (or sample) and the recording medium (or sample) as recited by amended independent claims 1 and 16. anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration") (emphasis added); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found"); and Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Knight fails to disclose that the probe is closer to the recording medium than the bottom surface of the slider.

In Fig. 3 of Knight, a flying head 300 is located adjacent to an optical recording medium 302. The head 300 has optics together with a slider 310. The slider 310 has a top surface 312, a channel surface 314, and air-bearing surfaces 316. The air-bearing surfaces 316 are the part of the bottom surface of the slider that is closest to the recording medium, and ride at a predetermined height above the recording medium 302 while the recording medium 302 is moving at a specific speed. Thus, the head 300 rides at a predetermined height with respect to the recording medium 302 by virtue of being carried by the air-bearing surfaces 316.

The optics include a reflector 320, an objective lens 330, and a solid immersion lens (SIL) 340, each of which is mounted to the slider 310. The SIL 340 is substantially or entirely contained within the slider 310. The objective lens 330 is mounted onto or near the top surface 312 of the slider 310 to focus the incident electromagnetic radiation, such as a laser beam, onto the SIL 340. An optically clear path 350 is provided between the SIL 340 and the objective lens 330 so that the electromagnetic radiation may be effectively transmitted from one to the other and back again. The optically clear path 350 includes any optically transparent material, and may be air, glass or optically clear plastic.

The electromagnetic radiation traveling through the path 350 is incident on the partial spherical surface 342 of the SIL 340. The SIL 340 can be a single partial sphere or a lesser portion of a partial sphere plus a flat plate. The SIL 340 has a generally spherical surface 342 which constitutes the partial spherical portion and a flat portion 344, which may be a flat surface or a flat plate.

However, the solid immersion lens (SIL) 340 does not extend below the part of the bottom surface of the slider closest to the recording medium as recited by amended independent claims 1 and 16. The bottom surface of the SIL 340 of Knight is co-planar with the bottom surface (air bearing surfaces 316) of the slider.

In particular, the two surfaces of the SIL, including the spherical surface 342 and the flat portion 344 are entirely contained within the body of the slider 310. The flat portion 344 is co-planar with or in the "vicinity" of the air-bearing surface 316 and is parallel thereto. As explicitly stated by Knight, the term "vicinity" means in the range of the dimensional tolerance of the hemispherical SIL, which is tens of microns for a typical hemispherical SIL or less than approximately 1 micron for a super-hemispherical SIL. The co-planar arrangement assists in the flight of the head 300 over the disk 302 and forms part of the total slider-air bearing surface.

Contrastingly, the invention recited by amended independent claims 1 and 16 has a probe which protrudes below a bottom surface of a slide so that the probe can be brought to within several nanometers to several tens of nanometers close to the recording medium or sample. Knight fails to disclose a probe protruding below a bottom surface of a slider so that the probe can be brought as close to the recording medium as recited by claims 1 and 16.

Accordingly, Knight does not anticipate the invention recited by independent claims 1 and 16 or the subject matter of dependent claims 2, 3, 20-22 and 32.

In view of the foregoing amendments and discussion, the application is now believed to be in condition for allowance. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicants

By: 

Bruce L. Adams
Reg. No. 25,386

50 Broadway - 31st Floor
New York, NY 10004
(212) 809-3700

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 1-3, 9, 19, 21 and 22 have been amended as follows:

1. (Twice Amended) A near-field optical head, comprising:

a slider supported by a suspension arm providing a load weight and obtaining a floating force due to a relative motion of the slider with respect to a recording medium so that [, and producing] a gap is produced between a bottom surface of the slider and a surface of the recording medium [in cooperation with the recording medium] due to a balance between the load weight and the floating force; and

a probe provided in the [a] bottom surface of the slider for producing a near-field light or converting a near-field light produced on a surface of the recording medium into a propagation light;

wherein the recording medium and the probe interact through the near-field light when the slider is caused to undergo scanning movement relative to a surface of the recording medium to thereby effect at least one of the recording of information onto the recording medium and the reproducing of information stored on the recording medium; and

wherein the probe protrudes from the bottom surface of the slider toward the recording medium so that a distance between the probe and the recording medium is smaller than a distance between a part of the bottom surface of the slider closest to the recording medium and the recording medium so that the probe can be brought to within several nanometers to several tens of nanometers close to the recording medium to enable high resolution optical reading and/or recording of data on the recording medium.

2. (Twice Amended) A near-field optical head according to claim 1; wherein the probe comprises a microscopic aperture formed in the slider for producing a near field light or converting a near-field light produced on a surface of the recording medium into the [a] propagation light.

3. (Twice Amended) A near-field optical head according to claim 1; wherein the probe comprises a microscopic protrusion extending from the bottom surface of the slider for producing a near field light or converting a near-field light produced on a surface of the recording medium into the [a] propagation light.

9. (Amended) A near-field optical head according to claim 4; wherein the [further comprising a] moving mechanism

[for] simultaneously controls [controlling] at least one of the amount and the direction of protrusion of the probe from the bottom surface of the slider, and scanning movement of the slider with respect to the recording medium.

19. (Amended) A near-field optical head comprising: a support member mounted to undergo relative movement with respect to a sample; and a probe protruding from a bottom surface of the support member for producing a near-field light or converting a near-field light produced at a surface of the sample into a propagation light; wherein the sample and the probe interact through the near-field light when the support member undergoes relative movement with respect to the surface of the sample; and wherein a part of the bottom surface of the support member closest to the sample is more distant from the sample than the probe so that the probe can be brought to within several nanometers to several tens of nanometers close to the sample.

21. (Amended) A near-field optical head according to claim 19; wherein the probe comprises a microscopic aperture formed in the support member for producing a near field light or converting a near-field light produced on a surface of the sample into the [a] propagation light.

22. (Amended) A near-field optical head according to claim 19; wherein the probe comprises a microscopic protrusion extending from the support member for producing a near field light or converting a near-field light produced on a surface of the recording medium into the [a] propagation light.